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SCIENCE

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SOME ECONOMIC ASPECTS OF THE WORLD WAR. II

The Espionage Act and the Trading-with-the-Enemy Act

Under the Espionage Act and the Trading-with-the-Enemy Act all exports and imports are placed under the control of the President with authority to delegate his powers. The control of exports was first exercised by the Exports Council, later by the Exports Administrative Board. This power still later passed to the War Trade Board, and there was added the control of imports. Orders have been issued so that at the present time the exportation and importation of all commodities of importance are completely controlled. The exportation of some is altogether prohibited and others prohibited except to our associates in war. Imports are likewise controlled in an appropriate fashion. Trade is altogether prohibited with the enemy or ally of the enemy; and with some 1,600 firms in neutral countries.

These regulations are exercised through licenses; and there is absolutely no exportation or importation of goods except by those who have licenses approving the particular transactions.

The Railroad

The Priority Administration is organized under the Priority Act. This act compels the railroads of the United States to handle all the transportation business of the country as the President directs. Under the act the President appointed Judge Robert S. Lovett Priority Administrator. In his work the administrator has had the cooperation of the carriers, of the Inter-

state Commerce Commission, and of the other special war administrations.

The Priority Administration has given a number of special orders for preference in shipment, and finally has issued a general priority order, which indicates the precise preference in handling the commodities which are necessary directly to carry on the war or indirectly to support the carrying on of the war, such as food, feed, and fuel. In short, the railroads must first provide for all of these needs in the order prescribed, ranging from steam railroad fuel through foods, to fuel necessary for domestic purposes, the public utilities, and for essential manufactories, etc. Only after these needs of transportation are provided for can the railroads handle other business.

In obeying the directions of the priority administration, the railroads are, by the terms of the Priority Act, freed from the penalties of the Sherman and other anti-trust laws.

The situation above described in regard to transportation was that in force until December 28, 1917, at which time everything was changed by the action of the President herein summarized.

In the act approved August 29, 1916, making the appropriation for the support of the army for the year 1916-17, the President was empowered through the Secretary of War to take possession and assume control of the transportation of the country for war purposes; and also "for such other purposes connected with the emergency as may be needful or desirable." A state of war was declared to exist between United States and Germany, April 6, 1917, and between the United States and Austria, December 7, 1917. Based upon the power vested in him by the above measures, the President on December 26, 1917, by proclamation, took over the entire railroad

system of the country and also the boats which are operating in connection with such railroads. The proclamation not only applied to the railways, but to the terminal companies and all the equipment of the railways of every kind. William G. McAdoo was appointed Director General of the Railroads. The proclamation became effective December 28, 1917, at 12 o'clock, noon, and the transfer of accounting took place at 12 o'clock, midnight, December 31, 1917.

Upon December 29, the Director General issued his first order. It was directed that the transportation system covered by the proclamation shall be operated as a national unit and that all facilities shall be used so as to give the highest efficiency. Routes designated by shippers are to be disregarded if these would interfere with the speed of transportation. Traffic agreements between carriers are not to interfere with the expeditious movements of freight. Through routes which have not heretofore been established because of short hauling or other causes are to be established and used wherever expedition will be promoted.

On January 4, 1918, the President addressed Congress in regard to the action which he had taken. He recommended that the compensation of the railroads for the service during the time they are under the management of the government should be the average of the net railway operating income for the three years ending June 30, 1917, and that the owners of the stocks and bonds of the railroads be guaranteed that they would receive this income.

On the same day a bill was introduced into Congress which proposes to carry out this recommendation. The measure also provides for an appropriation of \$500,000,000 as a rotating fund to operate the railways and to provide for the necessary additions, betterments, rolling stock, etc.

Many other features are embodied in the bill which it is not necessary to discuss. The control of the transportation system is to continue for the period of the war, and thereafter until otherwise ordered.

Taking over the transportation system of the country and operating it as a unit makes without force all of the antitrust laws. Instead of prohibition of the co-operation of the railroads, pooling, etc., there is a positive order that there must be the most perfect combination of all of the facilities of the country to give the highest efficiency. So far as the railroad system of the country is concerned, the antitrust laws are abolished for the period of the war.

The War Industries Board

The War Industries Board is a creation of the Council of National Defense. At the request of this board the producers agreed to maximum prices for copper, and for the more important forms of iron and steel. The prices fixed are the same throughout the country, except such allowances as are made for differentials due to freight, etc. Since the demand exceeds the supply, the maximum price is the price which obtains. Therefore producers of copper, iron, and steel sell at a definite price without regard to who is the purchaser. Competition in price is completely eliminated.

These agreements have been approved by the President. They have therefore the sanction of the law so far as the purchases of the government are concerned, since Section 120 of the National Defense Act authorizes the President to fix the price of all commodities for the government necessary for the prosecution of the war. But agreement upon prices for copper, iron and steel paid by the public have no warrant in congressional action.

The prices are large reductions from those which obtained before the agreements

were made, but are much higher and in many cases at least twice as high as those which prevailed in the pre-war period.

Also, by the request of the War Industries Board, the manufacturers have agreed to a definite order of preference. Under this priority agreement, first are to come war orders; second, those which are, while not directly for the war, of public interest and essential to the national welfare; and third, unessential commodities. Each manufacturer obtains permission of the War Industries Board to execute any order, and further executes its orders in accordance with the preference rules of the board.

Thus the War Industries Board through request has secured not only the agreement of the manufacturers in regard to the prices of steel, iron, and copper, but the preference in which the work is done. The steel and copper businesses are regulated to a large extent in the same manner as food and fuel are controlled in consequence of Congressional enactment.

Regulation by the Federal Court

The Federal Trade Commission by the direction of Congress investigated the print paper business and reached the conclusion that the control of this industry should be taken over and operated by the government during the war, and so recommended. Action by Congress upon this recommendation is pending.

In the meantime the Attorney General brought suit against the News Print Manufacturers' Association under the antitrust laws. The suit was not contested and the court issued a comprehensive order that the Manufacturers' Association should be dissolved. The Association and a number of its officers were fined. At the same time this was done the court entered into an agreement with each of the firms making up the Association, some forty in number,

in regard to the maximum price which should be paid for the different kinds of print paper for a period of three months, and after that term delegated the same authority to the Federal Trade Commission to the end of the war and three months thereafter.

All the members of the dissolved association entered into a contract with the court to execute this agreement. The manufacturers agreed with the court in the fixing of maximum prices throughout the country. Since, however, the demand is in excess of the supply, these maximum prices are in fact the prices everywhere paid.

Thus by court action, without any change of the law, the same results are reached for the control of prices of paper as are reached by the Food and Fuel Administrations concerning food and coal in consequence of the law and by the War Industries Board for the control prices of copper, iron, and steel. The reason given by the court for the exercise of this authority was, that in the present condition of affairs in the United States, it was desirable that some adjustment of the controversy be made.

THE PRINCIPLES UNDER WHICH MAXIMUM PRICES HAVE BEEN FIXED

In all of the price regulations, the board or other agent has had the very delicate task of so fixing the price that there will be a very large production without raising it so high as to be unreasonable. With liberal prices there is a strong incentive to increased production. If the price of a commodity were not only liberal but very high, the production might be still further slightly increased; but this final increment would not be sufficient to compensate for the higher price for all of the commodity to the public.

There is difference of opinion concerning the soundness of judgment which has been

exercised in price control; but it is noticeable that the criticism has been from both sides. The producers have held that the prices are not adequate; the consumers have felt that they are too high. As an illustration of the former, it may be mentioned that there is discontent among the farmers with the price fixed for wheat, although this is more than twice as high as that before the war. Similarly some of the coal producers have held that the prices which have been allowed are too low, although they are upon the average more than twice as high and in many instances thrice those that obtained before the war; and the profits of the operators are unquestionably much greater. On the other hand, the consumers have felt that the prices fixed for copper, iron, and steel are very high, yielding as they do enormous profits to each of the great producers.

It is, however, to be said that in all cases the administrative responsibility, in controlling prices, has been exercised by a group of men which has included representatives of producers, distributors, and consumers, and presumably upon the whole they have been determined as nearly right as is practicable for human beings acting under the stress of a great national emergency.

The regulatory measures have demonstrated that under a proper system, maximum price control is practicable; and, therefore, in the future, discussion should be limited to the question as to whether or not such price control is expedient; that is, whether or not it is advantageous or disadvantageous to the public.

Whenever, heretofore, price fixing has been advocated it has always been met with the objection that the proposal is impracticable. It has been said, if the government fixes prices, secretly they will be disregarded. This theoretical objection must

now face facts. The maximum price for wheat and its products, for fuel of different classes; for copper, iron, steel; and for print paper, have been controlled by governmental action; and these are the prices under which substantially all transactions have been carried on. There have been minor variations from those fixed, as illustrated by secret excessive charges for sugar; but as soon as such cases have become known, prompt punishment has come by compelling restitution or revocation of licenses. Excluding from consideration those dealings which have been made under contracts enforceable in law and made prior to the promulgation of regulatory measures, it is safe to say that more than 95 per cent. of the dealings in commodities in which maximum prices have been fixed have been within those prices.

It is to be noticed that this success has not been achieved simply by enacting regulations in regard to the maximum prices and leaving to the police offices and courts the problem of enforcement. All such attempts at price regulation have failed; and any similar future attempt would be certain to fail; just as the laws against discriminations, rebates, drawbacks, etc., for the public utilities failed as long as left to the courts for enforcement. These latter measures succeeded when an agency was created—the administrative commission or board—whose exclusive duty it was to see that the utilities laws were obeyed.

In the case of the present successful price-fixing movement, the controlling agencies have even greater powers than the utilities commissions. Through the license system, they inquire into charges and limit them at each stage of the process of distribution. For wheat and coal, the agencies have had also the authority to buy and sell the entire product of the country; and, for wheat,

the power has been exercised to the extent necessary to accomplish the desired end.

Therefore, the regulatory movement developed during the war has shown the way in which the principle of maximum price fixing can be carried out. This is not the least of its achievements; for no one supposes that maximum price-fixing can succeed, administered in an arbitrary manner and irrespective of cost. It was the combination of the exercise of broad powers through licensing, careful inquiry into cost, and giving due consideration to the necessity for large production that success in price control has been obtained.

REGULATORY MEASURES AND THE ANTITRUST LAWS

The facts presented show that for food, fuel, copper, iron, steel, paper, and transportation by land and water, the principles embodied in the Sherman and other anti-trust laws are directly contravened.

The fundamental ideas of the Sherman Act are that trade is controlled by the law of supply and demand and that in manufacture and transportation all are on an equal footing. Commodities are to freely flow as required by competition. If there is a shortage, the highest bidder will have his necessary needs met. There must be no cooperation in distribution. The common carriers must show no discrimination in goods. If there is cross freight, this is immaterial. The carrier must ship the goods as asked by the shipper.

Every one of these principles is directly violated under the control exercised through the war measures. Prices instead of being variable are the same for the same commodity at the same locality. For wheat the price is to be neither higher nor lower than that fixed by the Food Administration. For fuel, copper, iron, and steel, only maximum prices are fixed, but since the

demand exceeds the supply, the maximum prices are those in fact everywhere paid. The difference in prices for a commodity at different localities is only that necessary to compensate for freight differentials and other conditions.

In the matter of distribution, commodities do not go to the highest bidders but to the persons and places indicated by the control. The wheat and sugar remain at home and are sent abroad in proportions decided by the Food Administration. Fuel is furnished to the government and to corporations and individuals as decided by the Fuel Administration. Copper, iron, and steel are first to go directly to war purposes, then to purposes which are indirectly to assist in the war, and only what is left may go to unessential industries.

If the prosecution of the war is best furthered by so doing, commodities are sent abroad. If to do this it is necessary to curtail the home consumption, this is done. The control of exports and imports through licenses is completely in charge of the War Trade Board. The common carriers instead of acting independently and handling goods without discrimination must so cooperate in avoiding cross haulages as to give the highest efficiency; and they must handle goods in the order that the director general indicates.

In short, there is governmental control of many phases of industry and commerce for a number of the most essential commodities.

By express act, any form of cooperation in shipping which meets the approval of the Shipping Board, even to the extent of pooling, is exempted from the antitrust laws. The same is true for the railroads acting in accordance with orders of the Priority Administrator. No such express exemption is made for the agreements in regard to food and fuel. It is to be pre-

sumed that for these commodities the enactments of the food and fuel laws by Congress may be construed as repealing the anti-trust acts so far as the particular authority of these laws goes. Thus the fixing of the price of wheat and the control of wheat as a government monopoly are authorized by law enacted later than the Sherman and other antitrust acts; and they, therefore, in effect repeal these laws as far as these transactions are concerned.

However, for the transactions of the War Industries Board, there is no express law authorizing the copper, iron, and steel men to agree upon prices and to recognize priority. This board makes requests rather than issues orders. The price fixing is by agreement. These agreements may have the sanction of law by implication, so far as the purchases are by the government under section 120 of the National Defense Act. But it is clear that in agreeing upon prices for the public, the copper, iron, and steel men are violating the antitrust laws, and they are so doing by request of the War Industries Board, an instrument of the National Council of Defense, and with the approval of the President.

Incongruity of the Regulatory Measures and the Antitrust Acts

At the very same time these agreements are being made and are in force, the United States Steel Corporation is before the United States Supreme Court, charged with violating the antitrust laws by cooperation in controlling prices. Even if the charges are fully sustained, they do not go so far as the cooperation of the copper, iron, and steel men in response to the request of the government. Is this not indeed an extraordinary anomaly?

If the Steel Corporation is dissolved by the Supreme Court in consequence of the prosecution of the Attorney General, this

dissolution will be caused by actions less in violation of the law than those which the Steel Corporation has subsequently done at the request of the War Industries Board.

But the most curious anomaly of all is that in regard to book paper. The manufacturers of book paper are indicted for price fixing. The organization under indictment is dissolved and several of its members are fined. The court itself then enters into a contract with these same manufacturers to fix for three months the maximum price for print paper at somewhat lower rates than those fixed by the combination itself. The contract grants authority to the Federal Trade Commission to continue maximum price fixing throughout the war and three months thereafter.

Regulatory Measures Beneficial

Few, I suppose, will question that the regulatory measures authorized by law and those taken, without such authority, have been not only a benefit to the people but essential for the successful prosecution of the war. They have resulted in checking the enhancement of prices for essential commodities which, before these regulatory measures were enforced, were sailing skyward. Not only have rising prices been checked, but for many of the commodities they have been reduced—for food, fuel, and paper, moderately, and for copper, iron, and steel, largely. Also great economies have resulted from dividing orders among the different plants in such a manner that each does the work for which it is best fitted and nearest the location at which the commodity will be used. Already great additional economies have come from operating the carriers in such a manner as to reduce cross haulage and to lessen congestion. Also through the future operation of the railroads of the country as a unit under

a Director General vast additional economies are certain to be introduced.

The diversion of the wheat for export to the South instead of through the congested centers of the North and the East at a time when the transportation facilities of the country are taxed to the utmost is a vast economic gain. Also the diversion of the coal to the upper lake ports in advance of the closing of navigation will prevent great hardship which otherwise would have been inevitable.

Thus the majority of people will agree that the authorized exemptions from the antitrust laws, the exemptions from these laws by implication, the ignoring of them by the War Industries Board, and the action of the Court in enforcing them against the manufacturers and itself violating them, have all been beneficial.

Reconciliation of Anomalies

But the question arises whether all of these anomalies can be reconciled. The answer is yes. Amend the first section of the Sherman antitrust act, which forbids restraint of trade through combination and contract or by monopoly, by adding the clauses, "The restraint of trade meant by this act is that restraint of trade which is detrimental to the public welfare; and the presumption is that any restraint of trade is thus detrimental and to become legal must be approved by an appropriate governmental agency." Without special exceptions, if this amendment were made, it would legalize the cooperation of shipping, the cooperation of the railroads, and the actions of the Fuel and Food Administrations, the War Industries Board, and the Federal Court.

The facts presented show that cooperation by combination, contract, or monopoly may be beneficial or detrimental. Too frequently, when the control of the market

and monopoly have been in private hands without regulation, it has been detrimental; indeed so detrimental that this led to the enactment of the antitrust laws. When the control of the market or monopoly is, however, subject to governmental regulation, it may be highly beneficial; not only beneficial, but at a time of war, absolutely essential. The sanction, as far as public opinion is concerned, of all of the regulatory measures in regard to ships, railroads, food, fuel, copper, iron, steel, and paper, is that they have been a benefit to the people and have been essential for the successful prosecution of the war. There would have been no question about the legality and propriety of these acts, had the Sherman Act been amended in accordance with the suggestion made.

THE CONTINUATION OF REGULATION AFTER THE WAR

All the regulatory measures considered are for the duration of the war or for a limited period thereafter. If no action is taken by Congress, they will expire at varying intervals following the conclusion of peace.

Future Regulation to be based upon the Public Interest

The regulatory laws discussed are all based upon the war powers of Congress. In each one of them it is declared that the act is necessary for the public security and defense. If they are to be continued after the war, it must be upon the basis that the matters with which they deal are affected with a public interest; that is, the regulation, if continued, must be on the same principle as that which applies to the public utilities. Many of the utilities have received special privileges involving franchises; but irrespective of this, it is well established that regulation may be applied

to any business which is affected with a public interest. This goes back to the grain-elevator case, in which this broad principle was definitely settled. Can any one doubt that the business of an organization which controls half of the iron ore resources of the country, a large percentage of the coking coal, and manufactures half of the iron and steel of the nation is affected with a public interest? Or that the same is true of dealings in the most fundamental food commodities, such as wheat, sugar, meats, and fats? Therefore, undoubtedly Congress has the power to continue the regulatory measures after the war. This then raises the question should they be allowed to expire or be continued. The obvious general answer is that so far as they will be beneficial to the public they should be continued, but so far as they will be detrimental they should terminate. The difficulty will be in indicating those measures which under normal conditions will be beneficial and those that will be detrimental. In considering this problem, there are certain general considerations which should have weight.

Regulation Necessary to meet Foreign Competition

It is certain, that, following the war, combination abroad will be general. Already Germany is considering buying and selling nationally; and whether or not she decides to do this as a direct governmental activity, there is no question that the trading by Germany in any commodity will be done, if not through a single organization, at least through such a limited number that they will perfectly cooperate in their production and distribution.

Furthermore, it is highly probable that this cooperation will be extended so as to include her allies. Under these circumstances it is certain that any attempt to

meet Germany in world trade through the individualistic method under the law of supply and demand can not have the highest success. If we do not meet Germany's competition by national organization as efficient as her own, we may as well at once concede that Germany will gain a predominant position for those industries for which she has adequate resources.

Already this has been appreciated by Congress; and there is now in conference the Webb bill which, if enacted, will permit cooperation in foreign trade. This bill proposes to remove the handicap in selling goods abroad; and thus is in the right direction. It does not, however, permit cooperation in production within the United States; whereas such cooperation through cartels is legal in Germany. This powerful advantage Germany will retain. But if to meet this situation it be decided to permit cooperation within the United States, regulation is inevitable. If industry and commerce are freed from the restraints and penalties of the antitrust laws, there must be governmental agencies that shall see that advantage is not taken of the public in consequence of this fact.

Continuance of Regulation required to meet Needs of Allies

There is still another aspect of the question of continuing regulation which requires consideration. For a considerable period after the war, the demand for food and other essentials will be excessive. The cereal production of Great Britain, France and Italy has declined alarmingly during the war, because of lack of fertilizers and insufficient labor. Their herds are greatly depleted. These tendencies will continue throughout the war, so that their agricultural production will become even smaller. It is probable that for a long time, possibly for several years, we may have an insuffi-

cient surplus to even meet the legitimate needs of our associates in war; indeed it is little short of certain that this will be true for a number of commodities.

Shall we revert to the law of supply and demand under competition, and allow goods to be exported in unlimited quantities and without preference?

I do not know the answer others will make, but, for myself, it seems clear that the necessities of the allies must be met not only during the war, but for a sufficient period after the war so that their agriculture and industries may be rehabilitated; especially as such rehabilitation in Belgium, northern France and Serbia, is largely necessary because of ruthless and unnecessary destruction of property on a vast scale by the Central Powers and because of heavy drafts upon their financial resources wholly unwarranted by international law.

If the country accepts the answer suggested, it will require at the least that exports be controlled. Also if I am correct in believing that the demands for essential commodities after the close of the war will exceed the supply, the control of prices must continue, otherwise there will be another period of runaway prices; and with the present base from which it would start, this is not to be considered.

Continuance of Regulation will avoid Government Ownership

No thoughtful man can doubt, whether or not he believes in the extension of regulation, that great economic changes are inevitable following the war. The growth of the socialist group, heretofore mainly confined to other countries, will expand in the United States. Experiments on a gigantic scale of public control and even public operation of manufacture and commerce have been made in European countries engaged in the war and of less magnitude in

the United States. Also it has been demonstrated that in many directions, under the system of cooperation, efficiency and economy have been very greatly increased and unnecessary wastes reduced. With the mighty burden of the war debts upon us it will be absolutely necessary to continue this efficiency and economy. Therefore in advocating the continuance of the use of the principle of regulation for those fundamental commodities essential to the very life of the people or in the legal phrase vested with a public interest, I believe I am advocating the policy by which we may escape government ownership and operation.

For my part I am very reluctant to see the management of the industries of the country fall into the hands of a governmental bureaucracy. The emergency situation, due to our unpreparedness, when we entered the war, was met in large measure by the voluntary service to the government of thousands of our ablest men from business and many other walks of life. Under the extraordinary stress of the nation, incited by highly patriotic motives, they have left their private affairs and have taken positions wherever the country called. Their service is unbought. They are exerting their utmost energy for our country, and this will continue during the period of the war. But when the war ends, they will rightly return to their own affairs. They will not become a permanent part of government bureaus.

Heretofore agriculture, industry and commerce have been under the leadership of able men who have reached their positions as a result of the competition of ability. The citadel of defense of private property is that the system develops initiative and energy. These qualities give large rewards to the men possessing them. The

central point at which private property is attacked is that strong men use their powers for their own ends. The captains of industry have too often exercised their control without sufficient regard to the public interest.

What I am proposing is that property remain in private hands and that exceptional initiative and energy have exceptional reward, but that so far as business and industry are vested with a public interest they be subjected to regulation. Under this plan, those who controlled vast properties would necessarily exercise that control with due consideration for the masses of the people.

We should then have both the advantages of private property and the protection of the public. Should not this plan, both for the utilities and the essential commodities vested with a public interest be thoroughly tried out before we place the control of productive industry and commerce in the hands of governmental bureaucracies?

The Extent to which Regulation should be continued

In advocating the continuance of regulation after the war, I do not mean to imply that all the existing measures shall be retained in their present forms. It is yet too early to suggest a program in regard to the extent which this should be done. What I am advocating is that we maintain the principle that the essential commodities are subject to control in the public interest precisely as are the utilities. That principle recognized, regulatory measures should be continued only as far as necessary to meet the existing world conditions. In the further development of the policy of regulation we should proceed cautiously as occasion arises precisely as we did in the control of the public utilities.

CONCLUDING STATEMENT

This World War probably will cost hundreds of thousands, and it may cost millions of our men. It will require many billions of our treasure. This will put a heavy burden upon succeeding generations. The dreadful costs of the war we must bear. Should we not therefore gain everything possible from the experiences of the war? The vast savings due to more scientific production and distribution, if continued after the war, will in large measure, indeed, they may completely, carry not only the interest load imposed upon us, but even furnish a certain amount each year toward the liquidation of the principal. Without being able to demonstrate it, I believe it probable, that if, following the war, wise governmental regulation is continued for essential commodities as well as the utilities, the savings of the people may be sufficient to meet the money cost of the war. Nothing can compensate for the losses in men.

CHARLES R. VAN HISE

UNIVERSITY OF WISCONSIN

SCIENTIFIC EVENTS

AMOS PEASLEE BROWN

RESOLUTIONS were passed at the last meeting of the faculty of the Towne Scientific School of the University of Pennsylvania on the death of Professor Amos P. Brown as follows:

WHEREAS: In the death of Amos Peaslee Brown, for many years the professor of mineralogy and geology in the Towne Scientific School, the university has lost an honored and able scholar and original investigator; the faculty of the Towne Scientific School wishes to record its sense of the loss to this faculty and to the university, and to express also its sympathy to Professor Brown's family.

Amos Peaslee Brown was born in Germantown, December 3, 1864. He graduated from the Towne Scientific School in 1886, with the degree

of Bachelor of Science; he received the degree of Doctor of Philosophy in 1893. He subsequently became by advancement through various grades professor of mineralogy and geology in the University of Pennsylvania, holding this position until his retirement in the winter of 1916-17.

Dr. Brown was a man who by his fine personal character and high aims, and by his lovable disposition won warm and enduring friendships. His work while well known among scientific men did not attract publicity; he did not wish that it should, he was rather of the scholarly type which quietly, studiously and accurately pursues his chosen field. By reason of his philosophic and analytic mind, Dr. Brown was able to make specific application of his knowledge to the problems of other fields of science besides his more immediate one of the geological sciences.

His work carried him into the laboratory and field alike. He was the first geologist to visit and report on the geological formations of considerable general geological importance. He was at intervals connected with the Second Geological Survey of Pennsylvania. His papers cover a wide reach of general and specific scientific character.

Among the most notable recent investigations in America was the work done by Professor Brown in the field of crystallography; specifically the investigations in the classes of crystals found in the hemoglobins of the entire range of the vertebrate animals. In the course of this investigation Dr. Brown prepared, examined and calculated the functions of thousands of intricate and minute crystals, deducing from them conclusions highly important alike to organic and inorganic science. This work, carried out in collaboration with Professor Reichert, of this university, is one of the greatest contributions to exact science ever made in this country and is a lasting adornment to the fame of the University of Pennsylvania.

This faculty, therefore, in the realization of the loss to the entire university in the untimely death of their late colleague, passes this resolution of its appreciation of the man and of the loss to the University of Pennsylvania.

WORK OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS¹

IN March, 1917, the committee arranged, in conjunction with the National Research Coun-

¹ From the annual report of the executive committee of the National Advisory Committee for Aeronautics.